Minutes of the 104th Energy Calibration Meeting held on 23 August 1996

1 LEP2 RF Model

Mike Hildreth reported further checks of the forward and reflected powers, which in principle should allow a prediction of the average RF phase per klystron. However, these powers are not well calibrated, especially for the new units installed in 1996, and give unreasonable predictions for the phase. The forward power can also be calculated from the Q of the cavity, the voltage and the beam current. In this case, a guess of the scaling factor needed to bring the reflected power into a sensible range can be made, which might help to look for relative phase changes. 15 out of 20 SC half units need large scaling. An improved calibration of the forward and reflected powers can be made with beam by adjusting the cavity phase to be at the crest. This should be added to the list of things to do in the October run. It might then be possible to retrospectively use the logged forward and reflected powers from this run. To get an idea of the possible error introduced, global phase errors of 10 and 25 degrees were applied, together with "standard" and "worst case" alignment uncertainties. The maximum deviation seen is at the 10 to 15 MeV level for the correction to the centre of mass energy, which is tolerable for the present needs. Mike also showed plots of the ratio of Rbom measured/calculated at each IP, which show huge fluctuations and deviations from 1.

2 BOM, central frequency, beam-beam scans, flux loop and comparison with polarisation – the Joerg Wenninger show

Joerg presented the progress he has made on a long list of topics. The notes here indicate what can be found in the copies of his slides.

The logged BOM data seems to be of good quality. The behaviour of xarc is about as normal, but with one big jump just after the 80 GeV running began (and a much smaller shift at the time of the earthquake). To calculate the beam energy from the energy predicted by the dipole fields, i.e. to find the extra contribution from the quads, the difference between the physics RF frequency and central RF frequency must be known. The central frequency can be derived from xarc, once a relative offset has been established i.e. a central frequency measurement must be made. The quality of the high energy central frequency measurements was shown to be excellant.

143 out of 167 beam-beam deflection vernier scans were of good quality. The measured vernier settings, beam sizes etc. are in the measurement data base in M_VSBB_SUM, for easy use in deriving corrections. These also make it straight forward to display online the history of optimal vernier settings. The values are in good agreement with the measurements from the luminosity vernier scans.

During July and August, 31 flux loop measurements were made on 8 different occasions, with 7 full cycles at three different times. The drift of the integrators is also measured at plateaus in the ramp. One octant (IP's 2 to 3) shows fluctuations of the integrator which will be further investigated. The signals are corrected for integrator drift, for aging (factor 1.0004), and for overshoots of the power convertors. (This last correction was not included in flux loop measurements previously shown). The properties of the degauss cycle have been examined.

To convert from magnetic fields to beam energy, the effective length of the dipoles must be known. (This correction should also be applied to the NMR measurements in future.) The magnetic length changes by 2*10-4 going from 45 to 80 GeV.

Finally the flux loop and polarisation measurements are compared. The polarisation numbers are corrected for tide and quoted for the physics RF frequency (...4170Hz). The flux loop numbers are also corrected to this frequency, but no correction for temperature or dipole field rise as inferred from the NMR's has been made.

''peak''	MeV	delta,MeV
Pol 31/07	45 579	5
FL 25/07	45 584	
''peak-2''		
Pol 19/08	44 724	5
FL	44 729	
''50 GeV''		
Pol	50 005	17
FL	50 023	

If this difference between the values at 45 and 50 GeV is extrapoloated to 80 GeV it leads to a LARGE difference.

3 More details of the Polarisation MD

Bernd Dehning showed plots with the quality of the polarisation data and decalibrations at 45/50/60 GeV. It should be noted that there is a –2% offset in the polarimeter calibration. A polarisation of 4 to 5 % was achieved (with positrons) at 50 GeV. No clear signal was seen at 60 GeV.

The difference between the energy measured by polarisation and from the NMR's is –5 MeV on 31/07, 0 MeV at peak–2 on 19/08 and –37 MeV at 50 GeV. So this shows an even larger discrepency than the flux loop w.r.t. the polarisation data.

4 Results of NMR MD

Giuseppe Mugnai reported on the NMR studies. On the evening of 20 august the LEP ring was closed without beam to allow measurements of the NMR's in pit 1 with the magnets on. The amplitude of the resonance peak was observed to have decreased by 10–15%, so these Metrolab probes are showing some signs of radiation damage, although the measurement precision is so far unaffected. They are apparently much more robust than the Bruker probes. Further measurements will be made on a probe in the lab to establish what has degraded. The possibility of adding further shileding will be investigated, and buying Metrolab probes to replace the Bruker probes in octants 4 and 8 will be considered.

5 Towards Final 80.5 GeV Energy Calibration and Next Meeting

We should be aiming to have a reasonable final number on a short timescale – certainly by the beginning of October. However, there is a lot of work to do. The largest source of uncertainty at the moment is the energy extrapolation after the successful polarisation measurement at 50 GeV. This is looking difficult! Joerg will continue to work on the flux loop and associated issues. Fast progress on the comparison with NMR data, and in addition a usable "dipole" (train effect) model for the 80.5 GeV data based on the NMR's is needed, so these are at present a critical item. Unfortunately many key players are away right now. The RF model is unsatisfactory, but looks as though the error will be "sheltered" behind the extrapolation error for now. Progress on checking dispersion effects and vernier offsets is also important.

In view of absences, the next meeting will be at 14:00 on Friday 13 September in the pavillon. Subgroups are strongly encouraged to make as much progress as possible over the next three weeks and present an updated status at this meeting.

Pippa Wells, 23 August 1996.